CBR
COUNCIL FOR BUDGET RESPONSIBILITY

To Work or Not to Work?

Updated Estimates of Labour Supply Elasticities

Zuzana Siebertová, Matúš Senaj
Norbert Švarda, Jana Valachyová

Working Paper No. 3/2015

www.rozpoctovarada.sk

To Work or Not to Work?
Updated Estimates of Labour Supply Elasticities [1]

Zuzana Siebertova[2], *Matus Senaj*[3], *Norbert Svarda*[4], *Jana Valachyova*[5]

ABSTRACT

This paper provides a revised microeconometric analysis of extensive margin labour supply elasticities in Slovakia. Compared to earlier analysis, we estimate the elasticities for males and females separately. We find that a one percent increase in net wage increases the probability of economic activity by 0.21 and 0.4 percentage points for males and females, respectively. Taking into account tax and transfer system details valid in Slovakia in 2009-2012, a one percent increase in transfers decreases the semi-elasticity of labour force participation by 0.03 percentage points for males and 0.05 percentage points for females. These results are broadly in line with the elasticities usually reported in the literature. Our results show that low-skilled, females and the elderly are the groups that are particularly responsive to changes in taxes and transfers. Labour market policies aimed to boost employment should concentrate on increasing marginal gains to work, especially for low-educated individuals and women.

Keywords: labour supply elasticity, extensive margin, Heckman model, probit

JEL classification: H31, H53, I38, J21

---

[1] The authors would like to thank Gábor Kátay from Banque de France and Áron Kiss from European Commission for their help and support in this project. They are also grateful to Martin Guzi from the Masaryk University, Czech Republic for his valuable comments and suggestions. Special thanks goes also to Daniele Franco from the Ministry of Finance, Italy, to Michal Horváth, Ľudovít Ódor, Martin Šuster, and to our colleagues from the Council for Budget Responsibility and the National Bank of Slovakia.

[2] Corresponding author. Address: Council for Budget Responsibility. I.Karvaša 1, 813 25 Bratislava, Slovakia.
E-Mail: siebertova@rrz.sk

[3] Council for Budget Responsibility E-Mail: senaj@rrz.sk

[4] Council for Budget Responsibility. E-Mail: svarda@rrz.sk

[5] Council for Budget Responsibility. E-Mail: valachyova@rrz.sk

1 Introduction

Motivation to work is greatly affected by income taxes levied and social system valid in a country. Analysis of labour supply behaviour is a key element when evaluating reforms of tax and transfer systems and the impact of different policies on changes in tax revenues, employment or wealth redistribution.

Employing a full-parametric method allows us to assess how the Slovak tax-benefit system can affect work incentives. We document that participation and employment probabilities are in general dependent on the level of net income and transfers. We find that a one percent increase in net wage increases the probability of economic activity by 0.21 percentage points for males and 0.4 percentage points for females. Taking into account tax and transfer system details valid from 2009 to 2012, a one percent increase in transfers decreases the semi-elasticity of labour force participation by 0.03 and 0.05 percentage points for males and females. These results are broadly in line with the elasticities usually reported in the literature. Hence, our general message is that in terms of labour market behaviour, the Slovaks respond to incentives much the same way as their peers in V4/OECD economies[6]. Policy initiatives likely to increase gains to work should result in higher participation and employment rates. Our results also show that, in line with findings for other countries, low-skilled, females and the elderly are the groups that are particularly responsive to changes in taxes and transfers. Labour market policies aimed at boosting employment should, therefore, be primarily targeted at low-educated individuals and women.

These findings are important, as inactivity and unemployment rates persist to be high in Slovakia, and little has been done to formally assess the effects of taxes and social transfers on labour market inactivity. Participation rates in Slovakia are permanently below the EU-27 average but still rather high compared to neighbouring Hungary and Poland. Lack of job opportunities in Slovakia especially for labour market entrants and for individuals with low qualification persist. Employment rates of youth and low-skilled (low educated) workers are low, also compared to neighbouring V4 countries.

[6] The Visegrád Group, also V4, is an alliance of four Central European states: Czech Republic, Hungary, Poland and Slovakia – established for the purposes of cooperation and furthering their European integration.

Thus, presented results help understanding the incentive effects of tax and benefit policies, and should help policy makers to achieve the right balance between the generosity of social benefits and financial incentives to find a job.

Our estimates are based on a structural model of labour supply where both taxes and social transfers are simultaneously taken into account. We use a fully parametric approach to estimate a fully specified structural labour supply model where we address the questions of wage endogeneity[7], following Benczur, Katay, Kiss and Racz (2014). The model covers in minute detail the joint effects of tax and benefit systems on individuals' net income. Using this modelling strategy, individual participation probabilities are determined by comparing two states: being in labour force and being out of labour force. A key component of this approach is to precisely evaluate disposable income, including also non-labour income and social transfers of every individual in both states. In order to do so, a concept of *gains-to-work* is introduced and defined as the sum of net wage and transfers lost due to taking up a full-time job. Our first attempt to estimate labour supply elasticities in Slovakia is documented in Council for Budget Responsibility (CBR) working paper by Siebertova, Senaj, Svarda and Valachyova (2014). Since the effects of some specific family related factors could be different for males and females, in this paper, we estimate models and present results for males and females separately.

The essential part of this analysis is the SIMTASK module, a microsimulation model of the Slovak tax and transfer system described in detail in Siebertova, Svarda and Valachyova (2015). This tool enables us to simulate individual tax liabilities and benefit entitlements according to valid legislation or hypothetical reform.

A major advantage of this method is that it allows computing predictions of the impact of tax and transfer system reforms and moreover, it permits evaluation of specific government interventions and policies.

The rest of the paper is organized as follows. In the next section, we briefly summarize existing empirical approaches and the literature on estimation of labour market participation. In section 3, we present our empirical strategy (modelling approach). Section 4 follows with the data description, a brief introduction of the Slovak tax and transfer system and identification of

[7] Labour demand shifters are used as instruments for wages.

variables used in a model. Main results are reported and discussed in section 5. Finally, section 6 concludes and discusses major implications of the presented results on tax and welfare policy. In the Appendix we list definitions of main variables and present some additional details of our estimations.

2 A Brief Review of Existing Approaches and Literature

Literature on microeconometric estimations of labour supply elasticities is vast.[8] A number of studies conclude that extensive margin is much more important than intensive margin. Existing studies usually evaluate labour supply elasticities of some special demographic subgroups (single individuals, married women, couples, etc.). They usually find that wage elasticities are larger for women than for men.

However, despite the multitude of methodologies and information covered by existing studies, analyses focusing on Central and Eastern European countries are rather scarce and the case of Slovakia has been covered only in one paper so far. Chase (1995) compares labour force participation and wage elasticities between Communist and post-Communist regimes in Slovakia and the Czech Republic. He shows that women's participation in the labour market was higher under Communism. He concludes that the effects of changes in earnings are smaller in Slovakia compared to the Czech Republic. This is probably a result of slower transformation of the Slovak economy.

In this study, we follow the approach proposed by Benczur et al. (2014). Their paper studied labour supply at the extensive margin in Hungary. The authors extend an existing structural approach by including a tax and benefit system. As regards the participation decision, they report marginal effects of 0.4 and -0.13 for net earnings and social transfers, respectively. They also show that wages, taxes and transfers have a stronger influence on the participation decision of individuals that are older, low skilled or married women and women at child-bearing age. Recently, Galuscak and Katay (2014) followed the same methodology and provide the empirical estimates for the Czech Republic. Their estimates are close to those reported for Hungary,

[8] Chetty et al. (2013) present an interesting meta-analysis of estimates of extensive margin elasticities. They find average participation elasticity of 0.25. An overview of recent estimates of labour supply elasticities in the U.S. economy can be also found in McClelland and Mok (2012).

i.e. a one percent increase in net wage leads to a 0.37 percent increase in participation probability and a one percent increase in transfers decreases the participation probability on average by 0.12.

Bicakova, Slacalek and Slavik (2011) also focus on the Czech Republic. Their approach is more or less comparable to ours as they concentrate on the extensive margin only and provide estimates separately for males and females. After examining the outcomes of probit models it turns out that better statistical properties are achieved with the effective net wage. Authors find that wage semi-elasticities of labour supply are larger for women compared to men. However, the estimated wage semi-elasticities are very close to zero, they report 0.06 for women and 0.01 for men.

Most recent evidence on comparing labour supply elasticities in Europe and the US can be found in Bargain et al. (2012). The tax-benefit simulations are based on the EUROMOD microsimulation model. Authors use a discrete choice model of labour supply and, in a unifying framework, they confirm that the extensive margin dominates the intensive, and that own-wage elasticities are rather small.

3 Methodology

In this paper we examine the effects of income taxation and transfers on the participation decision of individuals, i.e. the labour supply responsiveness at the extensive margin. We use a fully parametric estimation of a structural labour supply model where taxes and transfers are treated in a unifying framework. The elasticities are estimated separately for males and females. First we briefly summarize the setup of the model and its identification. In the next subsection we present the structure of tax and benefit system in Slovakia and corresponding simulations.

3.1 Model and Identification

Methodologically, we closely follow the discrete-choice approach[9] presented in Benczur et al. (2014). The underlying theory starts with a standard utility maximization problem (defined as a consumption-leisure trade off) by using an additively separable utility function. Adding taxes

[9] Discrete-choice approach has been proposed by van Soest (1995). In this modelling framework, individuals that are maximizing their utility are supposed to decide between several discrete options of number of hours worked, like working full-time, part-time or not working at all (zero hours).

and social transfers to the model leads to redefinition of the reservation wage, such that the participation decision of an individual needs to be constrained to a full time job[10] (otherwise is individual inactive, see Benczur et al. (2014) for details). Participation decision is then defined by comparing the utility derived from working full-time and the utility from being inactive and receiving social transfers. Taking into account the corresponding budget constraint, estimating the probability of being economically active or employed then yields a structural probit equation.

To derive formal expressions, in the first step we introduce the concept of a *gains-to-work* variable W_i defined as a difference between net wage w_i and change in conditional social transfers ΔT_i:

$$W_i = w_i - \Delta T_i \,, \tag{1}$$

where $\Delta T_i = T_i^{hyp} - T_i^{obs}$ denotes a difference between hypothetical and observed transfers. In other words, ΔT_i is the sum of transfers an individual receives (or would receive) when not working and looses when working full-time.

Based on the underlying theory, gains-to-work W_i should be interpreted as a difference between the net effect from being employed full-time and the net effect gained from full amount of transfers at zero hours worked. Therefore, we construct gains-to-work W_i for an individual i as follows:

- For the *employed* we first compute the net income – as a sum of net income from employment, non-labour income and transfers that an individual i is entitled to at a given level of income. Net income from employment is computed from the reported gross income less the simulated (by our SIMTASK model) personal income tax and social security contributions. In the next step we assume a hypothetical scenario: income from employment is set to zero (non-labour income is left at its original level) and we compute the corresponding amount of transfers an individual is entitled to. W_i is then defined as a difference between the former and latter scenario.

[10] This approach can be justified by the fact that in Slovakia, most typical form of employment is a full-time employment. Less than 2% of respondents in SK-SILC survey with the income reference year 2012 defined their actual economic status as working part-time. Based on the data from the matched employer-employee survey ISAE (Information System on Average Earnings) that covers major part of the Slovak employment, 6.7% of employees worked in 2013 part-time. Similar situation has been documented in Hungary and the Czech Republic.

- For the *unemployed and inactive* we predict their gains-to-work by using a Heckman selection model, that is estimated separately for males and females (see below).

The second variable of principal interest to us is non-labour income NY_i which is defined as a sum of three components, namely conditional transfers, other non-labour income that an individual receives (e.g. pensions, income from property, interest, dividend payments, etc.) and income of other members of the household. Other non-labour income and income of other members of the household are independent of the labour market status of an individual, therefore they are computed in the same way for every person. However, the construction of the conditional transfers component T_i in the variable NY_i should be divided into the following steps:

- For the *employed* we assume hypothetical situation where labour income is set to zero (i.e. income "at zero hours worked") and non-labour income is left at its original values. Conditional transfers are then computed as hypothetical values an individual is entitled to by using SIMTASK microsimulation model of the tax-benefit system described below.

- For the *unemployed* we add one more step. First, we assign to all unemployed individuals predicted potential gross income (wage) using Heckman's methodology, where the driving factors in the model are based on personal characteristics. Again, potential wages are estimated separately for males and females. Then we proceed like in the case of the employed individuals and we compute their conditional transfers.

- For *pensioners* and *other inactive* we use the actual amount of social transfers they are entitled to. [11]

Equipped with vectors of gains-to-work and non-labour income we can focus on modelling and identification of driving factors of participation decisions to enter the labour market. Therefore, we consider two specifications of a structural probit regression model; the first one uses economic activity and the second one uses a dummy variable employed as dependent variable:

$$\Pr(\text{activity}_i) = \Phi(\gamma \widehat{\log W_i} + Z_i'\alpha + \psi \log NY_i), \qquad (2a)$$

[11] In fact, to be consistent in the whole set up of our labour-supply model, we use the simulated values of transfers and other non-labour income when they are available, i.e. when they can be computed by SIMTASK model. We use the actually observed values, as they were reported by survey participants, only when these are not simulated with microsimulation tax-benefit model.

$$\Pr(\text{employed}_i) = \Phi(\gamma\,\widehat{\log W_i} + Z_i'\alpha + \psi \log NY_i), \tag{2b}$$

where vectors of gains-to-work $\widehat{\log W_i}$ and non-labour income $\log NY_i$ enter the model in a logarithmic form[12] and Z_i denotes a vector of characteristics that affect the labour supply of an individual. Finally, both specifications given by equations (2a) and (2b) are estimated separately for males and females.

When unobserved characteristics of employed people systematically differ from the unobserved characteristics of unemployed, a simple wage regression estimated by OLS will provide biased estimates. Since income from employment is unobservable for those who are unemployed (it's an endogenous dummy variable), we first apply Heckman's sample selection methodology to predict the gains-to-work. In Heckman's framework, the model consists of two equations: a selection equation and regression equation. The first one estimates the probability (propensity score) of an individual to be employed/unemployed:

$$\Pr(\text{employed}_i) = \Phi(X_i'\beta + Z_i'\alpha + \psi \log NY_i)\ , \tag{3}$$

where X_i is a vector of those characteristics that affect the labour demand of an individual. The estimated propensity score model is then used to estimate the coefficients of a second regression equation that models the market wage (more specifically the gains-to-work). Formally, we estimate the wage regression by using the Heckman methodology to overcome the sample selection problem[13]:

$$\log W_i = X_i'\beta + \rho\lambda(X_i'\beta + Z_i'\alpha + \psi \log NY_i) + u_i\ , \tag{4}$$

where X_i is a vector of those characteristics that affect the labour demand of an individual, u_i is an error term and λ denotes the inverse Mill's ratio[14]. We assume that the error terms corresponding to equations (3) and (4) are independent across individual observations and jointly normally distributed with correlation ρ. The model is estimated jointly by maximum likelihood method.

---

[12] This comes from the derivation of the structural form of the model, see Benczur et al. (2014) for details.

[13] As noted by Galuscak and Katay (2014), this procedure can be understand also as IV probit, where the first stage is the Heckman selection model. The key of the identification procedure is the presence of „labour demand shifters" X_i that drive the market wage, while their influence on the labour supply is indirect (over wages), i.e. they act like excluded instruments.

[14] Inverse Mill's ratio is defined as a ratio of probability density function to the cumulative distribution function of a distribution.

Finally, the estimate of gains-to-work $\widehat{\log W_i} = X_i'\hat{\beta}$ comes as a result of the unconditional linear prediction from Heckman's model. These estimates then enter the structural probit equations (2a) and (2b). In order to reduce the division bias, we use the predicted gains-to-work $\widehat{\log W_i}$ for all observations (i.e. not only for employed but also for unemployed and inactive, as it is common in the labour supply literature, e.g. Bargain et al., 2012 or Breunig and Mercante, 2010).

Identification

The model is parametrically identified due to nonlinearities present in the tax-benefit system. Based on different personal characteristics (including not only the basic demographic variables but also family and household controls) and different levels of non-labour income, individuals may receive different net wages, although their gross wage is the same. As a result, they face different effective average and marginal tax rates. This provides enough cross sectional variation to estimate the gains-to-work and subsequently the elasticity of employment and participation probabilities.

Elasticities

Income elasticities in the structural labour supply model can be derived analytically. Notice that since the structural probit model is non-linear, point estimates of the coefficients do not indicate marginal effects of a unit change in the corresponding variables. To compute the marginal impact of a percentage change in gains-to-work, the probit function given by (2a) and (2b) should be evaluated at certain vectors Z and $\log NY$.

Since our wage measure gains-to-work is given in natural logarithm, note that in fact we evaluate semi-elasticities.[15] To calculate the corresponding income elasticities, one has to divide the computed semi-elasticities by the predicted probability of economic activity, evaluated at sample means of variables.[16]

[15] Income semi-elasticity (η) of labor force participation is defined as $\eta = \frac{\partial \Pr(activity=1)}{\partial W} \times W$ implying that marginal effect of wage on the probability of economic activity can be expressed as $MFX = \frac{\partial \Pr(activity=1)}{\partial \log W} = \gamma\Phi\left(\widehat{\log W_i} + Z_i'\alpha + \psi \log NY_i\right)$. The estimated effect should be interpreted such that a 1% rise in income leads to the increase of the probability of supplying labour by 0.01 x MFX.

[16] Income elasticity (ε) of labor force participation is defined as $\varepsilon = \frac{\partial Pr(activity=1)}{\partial W} \times \frac{W}{\Pr(activity=1)}$ and can be calculated as $\varepsilon = \frac{\eta}{\Pr(activity=1)}$, knowing the values of semi-elasticity η and predicted probability of activity $\Pr(activity = 1)$.

Moreover, in the structural probit model of labour force participation we evaluate directly the effect of gains-to-work and non-labour income. The separate impact of change in the net wage (w) can be derived as follows:

$$\frac{\partial \log W}{\partial \log w} = \frac{\delta \log(w - \Delta T)}{\delta \log w} = \frac{\delta \log\left(e^{\log w} - \Delta T\right)}{\delta \log w} = \frac{e^{\log w}}{e^{\log w} - \Delta T} = \frac{w}{w - \Delta T}$$

Using the previous relationship we find that the net wage semi-elasticity of probability of supplying labour can be expressed as:

$$\frac{\partial \Pr(\text{activity} = 1)}{\partial \log w} = \frac{\partial \Phi}{\partial \log w} = \frac{\partial \Phi}{\partial \log W}\frac{\partial \log W}{\partial \log w} = \hat{\gamma}\frac{w}{w - \Delta T} \qquad (5)$$

Similarly, for the separate effect of transfers (T), which are only a part of non-labour income, we can write:

$$\frac{\partial \Pr(\text{activity} = 1)}{\partial \log T} = \frac{\partial \Phi}{\partial \log T} = \frac{\partial \Phi}{\partial \log NY}\frac{\partial \log NY}{\partial \log T} + \frac{\partial \Phi}{\partial \log W}\frac{\partial \log W}{\partial \log T} = \hat{\psi}\frac{T}{NY} + \hat{\beta}\frac{-T}{w - \Delta T} \qquad (6)$$

4 Data and tax-benefit system simulations

The data used for microeconometric analysis come from four waves (2009-2012) of SK-SILC, the national version of EU-SILC[17]. Data are collected on an annual basis from 2004 by the Statistical Office of the Slovak Republic on behalf of EUROSTAT. The dataset contains cross-sectional data on household and individual level and it provides information on income, living conditions, social exclusion and poverty. The original datasets contain information on more than 15,000 individuals and 5,200 households annually. We combined these four datasets to a pooled cross-section and estimate structural models as a pooled regression.[18]

The SK-SILC comprises detailed information describing the personal characteristics of individuals. These include age, gender, education and region of permanent residency and marital status. The dataset also reports detailed information related to labour market status – whether an individual was employed (full-time, part-time), self-employed or whether he stayed unemployed in the reference period. Information on the length of working history (in years) is

[17] Abbreviation SILC stands for "Statistics on Income and Living Conditions".
[18] EU-SILC database for Slovakia is constructed as a rotating panel database with one fourth of data updated each year. However, in our micro-simulations we need to work with a national extended version SK-SILC, which is not available as a panel.

also available. Furthermore, extensive information on the structure of individual income is available. Survey participants were asked to declare their yearly gross earnings from employment (self-employment), fringe benefits, and also transfers from the state, e.g. unemployment benefits or pensions (old-age, disability). Further description and summary statistics of variables can be found in Tables A1-A2 in the Appendix.

4.1 SIMTASK: a microsimulation model of the Slovak tax-benefit system

A microsimulation model SIMTASK has been developed by CBR as a tool that can simulate individual tax liabilities and benefit entitlements according to policy rules. Description of the main characteristics of the Slovak tax-benefit system, development of the model and validation tests of the simulations are comprehensively documented in the related paper by Siebertova et al. (2015). Simulations cover direct taxes (namely labour and capital income taxes), social insurance contributions and selected transfers (unemployment benefit, material need benefit and family related transfers).

4.2 Identification of variables in the model

We first focus on the definition of economic activity and employment status that are dependent variables in the structural probit model. We define employed/unemployed status of an individual based on the prevailing economic activity in the reference period. Being active is defined in terms of ILO definition of economic activity.[19]

Income variables are necessary to generate gains-to-work; those which are collected on the individual level are listed in gross terms on yearly basis in SK-SILC. The only exception is the net profit (loss) from self-employment. Information on disposable income, income taxes and social security contributions are available in the SK-SILC database only as an aggregate at the household level. Therefore, all income variables are used in gross terms and the net income is simulated.

[19] For the definition of labour market status we use the SILC variable „prevailing activity in the income reference period“, it comprises the following categories: children, employed, unemployed, pensioners and other inactive. Economically active are those who declared themselves as employed or unemployed, category of inactive consists of pensioners and other inactive.

Actually, we distinguish between three different types of income: labour-income, non-labour income and transfers from the government. Labour-income includes gross wage from main and second job, income from self-employment, income from company shares and income from agreements. Information on fringe benefits, severance and termination payments, and company car is also available. Non-labour income covers income from rental of a property or land, interests, dividends and profit from capital investments.

Referring to equation (4), covariates in the Heckman selection model consist of two sets of variables: labour demand shifters X_i and labour supply shifters Z_i. As it has already been documented in the literature (see e.g. Kimmel and Kniesner, 1998 or Benczur et al., 2014) labour demand shifters X_i contain controls that affect market wage while the labour supply shifters Z_i include demographic and family characteristics.

In our implementation, the labour demand group composed of X_i controls for the wage and therefore does not affect labour supply directly (or has only marginal impact). These variables contain the degree of urbanization of a region where a person resides (dense, normal and sparse density) and regional dummy variables (8 regions based on NUTS2 classification). These two variables should capture differences in regional economic environment and thus control for the activity indirectly. We include also age and age squared and interaction terms of age with education dummies. The year dummy variables are also included in the specification. These variables serve as instruments for our wage estimations – we argue that age as a proxy for experience significantly influences the market wage, but it does not affect selection into employment, i.e., it can serve as a labour demand shifter. Besides this, these variables also serve as a source of additional variation in the model (consider prediction of the $\widehat{\log W_i}$ in Heckman's model). Note that different phases of individual life cycle (pre-prime age, prime-age, elderly, student and pensioner) are already controlled for in the labour supply equation.

Labour supply shifters group Z_i contains controls like three age groups (15-24, prime age 25-49 and elderly 50+), three educational groups (education level is stated as a dummy of the highest level achieved) and working experience expressed as a share of actual to potential experience. Moreover, we include years of experience and years of experience squared. Here, age group dummies are included as a labour supply shifter that control for the life-cycle position. We also include health status (whether person reports a chronic or longstanding illness), being a parent of child (under 3 years of age, 3 to 6 years old, older than 6 years), being a student, a pensioner and student attending a full-time education. Lastly, dummy variables for family status control (single, married, divorced and widowed), for car ownership and monthly instalments of mortgage and loans are included among controls of individual characteristics in the structural probit model.

4.3 Setup of the sample

The dataset we use is restricted by age to persons older than 15 and younger than 75, to exclude children in full-time education and those in retirement. Persons who declare themselves as employed (reporting positive number of months being employed), but who report income below minimal wage, are also dropped. Moreover, we also exclude those individuals, where the prevailing economic activity in the income reference period could not be defined. These adjustments leave us with approximately 36,000 individual observations in the pooled estimation sample.

5 Findings

In this section we present and discuss a large set of estimation results. We start with the estimation of the standard Heckman selection model to obtain predictions of gains to work of all individuals in the sample, such that we take into account selection into employment (see equation (4)). The estimation results of the Heckman model are reported in Table A3 in the Appendix. Statistically significant effect of selection has been proved by the likelihood ratio test. By using the Heckman model, the intention is to obtain precise estimates of gains to work. It turns out that separate estimation of gains to work for males and females led to estimates that fit the data more closely[20] than specification where gender is used as a dummy. The results are mostly in line with findings on net wages that can be found in the academic studies analysing other market economies. In particular, wages rise with age and education and a concave shape of age-earnings profiles could be detected. The selection equation shows that the probability of employment rises with education and working experience acts also as a positive determinant.

[20] We compared the fit of these specifications (males and females estimated separately versus full model with gender as a dummy) by using the RMSE criteria and the test was performed on the subsample for the employed. Details are available upon request.

Compared to prime-age (25-49 years), falling into category of pre-prime age and elderlies effects selection negatively. Non-labour income (including social transfers) has a significant negative effect on selection, which is in line with results documented in the literature. Reporting chronic illness, being a student or pensioner decreases probability of employment. In order to capture the effect of parenthood, three dummy variables corresponding to child age categories are included (up to 3 years, 3 to 6 years and over 6 years). Age of the child up to 3 years should catch the effect of paid parental allowance and at the age of 6 years children start attending the school. It turns out that being a mother of a small child younger than 6 years significantly decreases the probability of being economically active or employed, when having a child older than 6 years the effect becomes significantly positive. However, being a father of a small child of arbitrary age increases activity.

Equipped with the prediction of the constructed variable gains to work $\widehat{\log W_i}$ that comes out from the Heckman model, we estimate two specifications of the structural probit model using labour force participation and employment status as dependent variables, separately for males and females. Point estimates and goodness-of-fit measure pseudo R2 are listed in Table A4 in the Appendix. Estimates of parameters are again in line with usual findings, significance and direction of dependencies is similar to those described for the selection equation of the Heckman model above. Looking at the family status controls; living with working partner, being married, divorced or widowed increases the probability of being economically active or employed. Finally, car ownership and repayment of loans proved to have a significant effect on the probability of activity.

In Table 1 we report our main results: the marginal effects from the estimated structural probit model evaluated at sample means, i.e. for *average* individuals in given sub-samples. Later we concentrate mainly on labour force participation (economic activity), for the probability of employment we display only results of the main specification. Looking at both specifications, the computed results are statistically significant and have the expected sign, i.e. an increase in gains to work increases the probability of participation both for males and females, while the opposite is true for non-labour income. Qualitatively the results of both specifications are comparable.[21]

Table 1: Marginal effects – main specification

	Males		Females	
Dependent variable: Active	**dy/dx**	**std err**	**dy/dx**	**std err**
Gains to work (*logW*)	0.187	0.024	0.360	0.034
Non-labour income (*logNY*)	-0.107	0.008	-0.156	0.009
Net wage	0.206	0.026	0.401	0.038
Transfers	-0.028	0.002	-0.051	0.004
Dependent variable: Employed	**dy/dx**	**std err**	**dy/dx**	**std err**
Gains to work (*logW*)	0.234	0.028	0.425	0.034
Non-labour income (*logNY*)	-0.126	0.008	-0.134	0.008
Net wage	0.257	0.031	0.473	0.038
Transfers	-0.034	0.003	-0.057	0.004

**Note: Marginal effects are evaluated at sample means.*

Source: authors' calculations.

A one percent rise in gains to work increases the individuals' probability of economic activity by 0.19 and 0.36 percentage points for males and females, respectively. This effect is even more pronounced for the net wage (see equation (5)). On contrary, the effect of non-labour income and transfers is lower (in absolute value); a one percent increase in non-labour income leads to 0.11 and 0.16 percentage points decrease in supplying labour for both subgroups. Since transfers are only a part of non-labour income, the effect of transfers is substantially smaller.

Given similar methodology, our results for selected subgroups are directly comparable to the estimates reported for Hungary by Benczur et al. (2014) and are also consistent with the results of a similar analysis conducted for the Czech Republic by Galuscak and Katay (2014). In terms of the magnitude of the computed elasticities, we found somewhat lower values (both net income and transfers elasticities) compared to the ones reported for Hungary, and our results came close (mainly in terms of low transfers elasticities) to the results computed for the Czech Republic.

Next we focus on selected subgroups of individuals and explore how the estimated semi-elasticities change. In Table 2 we present a comparison of marginal effects computed for the

[21] Conditional marginal effects for the dependent variable "Employed" divided by subgroups are available upon request.

three educational subgroups (elementary or less, secondary and tertiary education) on prime-age subsample (25-49 years) and separately for males and females. The estimated semi-elasticities are substantially different by educational subgroups: the highest responsiveness is observed in the low-educated group with elementary education (these individuals are often highly transfers-dependent). Our results suggest that participation elasticities substantially decrease with educational level for both genders. Contrasting males and females, responsiveness of females is in higher educated groups more than three times higher compared to males. Notice that in agreement with previous studies, the prime-age subgroup of higher educated males exhibits overall low responsiveness to the tax and transfer system reforms.

Table 2: Marginal effects by educational subgroups and prime-age subsample

Marginal effects by subgroups	Males		Females	
	dy/dx	std err	dy/dx	std err
Elementary education				
Gains to work (*log W*)	0.185	0.026	0.357	0.035
Non-labour income (*logNY*)	-0.106	0.008	-0.155	0.009
Net wage	0.207	0.029	0.426	0.042
Transfers	-0.038	0.003	-0.091	0.007
Secondary education				
Gains to work (*log W*)	0.048	0.007	0.178	0.018
Non-labour income (*logNY*)	-0.027	0.002	-0.077	0.005
Net wage	0.055	0.008	0.213	0.022
Transfers	-0.012	0.001	-0.044	0.004
Tertiary education				
Gains to work (*log W*)	0.036	0.005	0.152	0.015
Non-labour income (*logNY*)	-0.020	0.002	-0.066	0.005
Net wage	0.041	0.006	0.180	0.018
Transfers	-0.009	0.001	-0.037	0.003

Note: Probit estimates are computed separately for males and females using the corresponding full sample and marginal effects are evaluated at sub-group specific sample means.

Source: authors'calculations.

In Table 3 we report results for the sub-groups classified by gender and marital status. Overall, the responsiveness of females is larger than that of males. Prime-age married males are identified as the sub-group with the smallest elasticity. We do not find substantial differences in responsiveness when single and married prime-age women are compared. The group of elderly (above 50 years) shows the highest responsiveness regardless of gender.

Table 3: Marginal effects by selected subgroups

	dy/dx	std err		dy/dx	std err
Prime age, males			**Prime age, females**		
Gains to work (*logW*)	0.048	0.007	Gains to work (*logW*)	0.176	0.017
Non-labour income (*logNY*)	-0.028	0.003	Non-labour income (*logNY*)	-0.076	0.005
Net wage	0.055	0.008	Net wage	0.210	0.021
Transfers	-0.012	0.001	Transfers	-0.043	0.003
Prime age, single males			**Prime age, single females**		
Gains to work (*logW*)	0.092	0.014	Gains to work (*logW*)	0.164	0.016
Non-labour income (*logNY*)	-0.053	0.005	Non-labour income (*logNY*)	-0.071	0.005
Net wage	0.109	0.016	Net wage	0.196	0.019
Transfers	-0.038	0.003	Transfers	-0.058	0.004
Prime age, married males			**Prime age, married females**		
Gains to work (*logW*)	0.027	0.004	Gains to work (*logW*)	0.172	0.018
Non-labour income (*logNY*)	-0.016	0.002	Non-labour income (*logNY*)	-0.074	0.005
Net wage	0.031	0.004	Net wage	0.200	0.020
Transfers	-0.005	0.001	Transfers	-0.034	0.003
Elderly (>=50), males			**Elderly (>=50), females**		
Gains to work (*logW*)	0.252	0.035	Gains to work (*logW*)	0.345	0.038
Non-labour income (*logNY*)	-0.144	0.010	Non-labour income (*logNY*)	-0.150	0.008
Net wage	0.271	0.038	Net wage	0.367	0.040
Transfers	-0.028	0.003	Transfers	-0.028	0.002

Note: Probit estimates are computed separately for males and females using the corresponding full sample and marginal effects are evaluated at sub-group specific sample means.

Source: authors' calculations.

Finally, in Table 4, we look at the sub-groups divided by income levels, here represented by the gains-to-work quintiles. Results for prime age males and females differ: response of males is again significantly lower. In both groups, elasticities decrease with income level, but for the fifth quintile in female subgroup they show to be unexpectedly high. Cross quintiles differences in computed elasticities are larger at the lower end, i.e. between first and second quintiles.

Overall, thus, our results suggest that policies that make work pay would lead to an increase in participation and employment. The low-skilled, females and the elderly are groups that are more responsive to changes in taxes and transfers. This implies that labour market policies (i.e. tax and transfer system reforms) that are aimed at boosting activity and employment should be primarily targeted at low-educated individuals and women.

Table 4: Marginal effects by income quintiles and prime-age subsample

Marginal effects by subgroups	Males		Females	
	dy/dx	std err	dy/dx	std err
Q1	**(below 3,624 euro)**		**(below 3,344 euro)**	
Gains to work (*logW*)	0.140	0.031	0.293	0.042
Non-labour income (*logNY*)	-0.080	0.009	-0.127	0.009
Net wage	0.190	0.043	0.435	0.062
Transfers	-0.068	0.013	-0.165	0.021
Q2	**(below 4,725 euro)**		**(below 4,301 euro)**	
Gains to work (*logW*)	0.079	0.016	0.191	0.025
Non-labour income (*logNY*)	-0.045	0.004	-0.083	0.006
Net wage	0.101	0.020	0.245	0.032
Transfers	-0.034	0.005	-0.066	0.007
Q3	**(below 5,782 euro)**		**(below 5,159 euro)**	
Gains to work (*logW*)	0.062	0.011	0.154	0.017
Non-labour income (*logNY*)	-0.036	0.003	-0.067	0.005
Net wage	0.077	0.014	0.187	0.021
Transfers	-0.024	0.003	-0.043	0.004
Q4	**(below 7,332 euro)**		**(below 6,389 euro)**	
Gains to work (*logW*)	0.045	0.007	0.103	0.010
Non-labour income (*logNY*)	-0.026	0.002	-0.045	0.003
Net wage	0.052	0.008	0.118	0.011
Transfers	-0.012	0.001	-0.020	0.002
Q5	**(above 7,332 euro)**		**(above 6,389 euro)**	
Gains to work (*logW*)	0.030	0.003	0.172	0.008
Non-labour income (*logNY*)	-0.017	0.002	-0.075	0.007
Net wage	0.032	0.003	0.192	0.009
Transfers	-0.004	0.000	-0.027	0.001

Note: Probit estimates are computed separately for males and females using the corresponding full sample and marginal effects are evaluated at sub-group specific sample means.

Source: authors'calculations.

6 Conclusion

In this paper we provide the estimates of the responsiveness of labour supply at the extensive margin for males and females in Slovakia. We use a structural labour supply model that takes into account both taxes and transfers and estimate net income semi-elasticity of labour force participation.

This analysis shows several clear results. We identify significant individual responsiveness to the tax and transfer system. It turns out that the results are qualitatively comparable to those reported for mature market economies: highly responsive groups of population are the low-skilled, females and the elderly. These findings are in line with our initial expectations, however the overall elasticity to transfers has been found low. On reflection, this is also not surprising, since a more detailed examination of the composition of the individual non-labour income reveals that transfers constitute only a small part of it, which is a consequence of the relatively low generosity of the Slovak benefit system. Our results are similar in both principle and magnitude to those found in the literature for neighbouring countries in the region (Czech Republic and Hungary) and for more distant mature economies.

In future work, we plan to investigate if labour supply elasticities at the extensive margin vary with the state of the aggregate economy. The model presented in this study is a static microsimulation model and its value lies primarily in assessing how the Slovak tax-benefit system affects willingness to work. It can be used as an a priori assessment tool to evaluate different policies, but this will only lead to partial equilibrium results. In a more comprehensive evaluation of the long-run fiscal and labour market consequences of larger policy reforms, the behavioural effects of policy measures should also be taken into account. Therefore, as a next step, we plan to link our microsimulation exercise, together with an assessment of labour supply elasticities at the intensive margin, to a small general equilibrium macro model.

7 References

Bargain, O., Orsini K. and Peichl, A. (2012): "Comparing Labor Supply Elasticities in Europe and the US: New Results", IZA Discussion Paper 6735, Institute for the Study of Labor, Bonn, Germany.

Benczur, P., Katay, G., Kiss A. and Racz, O. (2014): "Income Taxation, Transfers and Labour Supply at the Extensive Margin", Working Papers 487, Banque de France.

Bicakova, A., Slacalek, J. and Slavik, M. (2011): "Labor Supply after Transition: Evidence from the Czech Republic," Czech Journal of Economics and Finance (Finance a úvěr), 61(4) 327-347.

Breunig, R. and Mercante, J. (2010): "The Accuracy of Predicted Wages of the Non Employed and Implications for Policy Simulations from Structural Labour Supply Models", The Economic Record, The Economic Society of Australia, vol. 86(272), pages 49-70, 03.

Galuscak, K. and Katay, G. (2014): "Labour Force Participation and Tax-Benefit Systems: A Cross-Country Comparative Perspective," Working Papers 2014/10, Czech National Bank.

Chase, R., S. (1995): "Women's Labor Force Participation During and After Communism: A Case Study of the Czech Republic and Slovakia". Yale Economic Growth Center Working Paper No. 768.

Chetty, R., Guren, A., Manoli D., S. and Weber, A. (2013): "Does Indivisible Labor Explain the Difference Between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities," in Acemoglu, D., Parker, J. and Woodford, M. (eds.), The NBER Macroeconomics Annual, 27, 1-56.

Heckman, J., J. (1993): "What Has Been Learned About Labor Supply in the Past Twenty Years?" The American Economic Review, 83(2) 116-121.

Kimmel, J. and Kniesner, T., J. (1998): "New evidence on labor supply: Employment versus hours elasticities by sex and marital status," Journal of Monetary Economics, Elsevier, vol. 42(2), 289-301.

McClelland, R. and Mok, S. (2012): "A Review of Recent Research on Labor Supply Elasticities" Congressional Budget Office Congressional Budget Office.

OECD (2011): "Employment Outloook", OECD Publishing.

Porubsky, M., Machlica, G. and Strizencova, K. (2013): EUROMOD Country Report, Slovak Republic (2009-2012), Institute for Social & Economic Research, University of Essex.

Siebertova, Z., Svarda, N. and Valachyova, J. (2015): "SIMTASK: Microsimulation model of the Slovak Tax-Benefit System", CBR Discussion paper No. 3/2015.

Siebertova, Z., Senaj, M., Svarda, N. and Valachyova, J. (2014): "To Work or Not Work? Estimates of Labour Supply Elasticities", CBR Working Paper No. 1/2014.

Van Soest, A. (1995): "Structural Models of Family Labor Supply: a Discrete Choice Approach", Journal of Human Resources, 30, 63-88.

World Bank (2012): Providing the right incentives: Analysis of the tax-benefit system in the Slovak Republic, Social Safety Net Assessment and Poverty Mapping. Available at: http://www.employment.gov.sk/en.html

World Bank (2011): Implementing the Benefit in Material Need in the Slovak Republic. Available at: http://www.employment.gov.sk/en.html

Appendix

Table A1: Components of constructed variables in the model[22]

List of variables - definitions	
Active*	Binary indicator that equals 1 if the person is economically active in the income reference period.
Employed	Binary indicator that equals 1 if the person is employed in the income reference period.
Gains to work (*logW*)	Variable defined as the difference between net income and transfers lost due to taking up a job. Net income is defined as the sum of income from employment and non-labour income. Income from employment is given in net terms, i.e. as a gross wage minus social security contributions and taxes. Labour income consists of the following SILC variables: *Gross wages, Self-employment income, Other payments made by employers, Income from agreements, Fringe benefits, Severance payments, Termination pay (lump sum), Income from abroad*. Non-labour income consists of the following SILC variables: *Private pensions, Investment income-interests, Disability benefit, Old-age pensions, Widow's, widower's and orphan's pension, Other survivor benefits, Sickness and nursing benefits, Means-tested scholarships, Maternity benefit, Child birth grant, Child benefit*. Transfers comprise of: *Parental allowance, Contributory unemployment benefit, Material needs benefit*. Transfers that do not change subject to change in the labour market state of the person are included in non-labour income. We denote as transfers those variables that change their value subject to change of the labour market state.
Non-labour income (*logNY*)	Variable defined as the sum of transfers, other individual's non-labour income and income of other members of the household.
Female	Binary variable that equals 1 if the person is woman, 0 if man.
Education group dummies	3 binary variables are created based on ISCED classification (**EDU: Primary** [reference cat.], **EDU: Secondary**, **EDU: Tertiary**). If the person belongs to a group according to his highest degree awarded, the corresponding binary variable equals 1, otherwise 0.
Age group dummies	3 binary variables are created based on age groups (**Age 15-24** [reference cat.], **Age 25-49**, **Age 50+**). If the person belongs to a group according to his age, the corresponding dummy variable equals 1, otherwise 0.
Actual/Potential experience	Variable representing the ratio of person's actual and potential experience in years. Actual experience in paid work is reported. Potential experience is expressed as the number of years since the person has finished his education.
Chronic disease	Binary indicator that equals to 1 if the person reports a chronic/long standing disease.

*Variable names are given in bold.

Parent with child under 3y.	Binary indicator that equals to 1 if the person is a parent of a child that is younger than 3 years.
Parent with child 3-6y.	Binary indicator that equals to 1 if the person is a parent of a child that is 3 to 6 years old.
Parent with child over 6y.	Binary indicator that equals to 1 if the person is a parent of a dependent child that is over 6 years old.
Student	Binary indicator that equals to 1 if the person is a student, 0 otherwise.
Pensioner	Binary indicator that equals to 1 if the person is a pensioner, 0 otherwise.
Working Partner	Person has a working partner
Family status dummies	5 binary variables are created based on family status (**Single** [reference category], **Married**, **Separated**, **Divorced**, **Widowed**). If the person belongs to a group according to his family status, the corresponding dummy variable equals 1, otherwise 0.
Age	Variable indicating the person's age.
Age^2	The person's age squared.
Degree of urbanisation	3 binary variables are created based on number of inhabitants of the area where the person resides (**Dense** [reference category], **Average**, **Sparse**). If the person belongs to a group according to the degree of urbanization of his residence, the corresponding dummy variable equals 1, otherwise 0.
Mortgages and loans	Binary indicator that equals 1 if the person pays a mortgage or loan in the income reference period.
Car ownership	Binary indicator that equals 1 if the person owns a car.

Table A2: Descriptive statistics of the estimation samples SK-SILC 2009 -2012

Dataset	SK-SILC 2009		SK-SILC 2010		SK-SILC 2011		SK-SILC 2012	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Active	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5
Employed	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5
Gains to work	434.1	283.6	452.5	368.9	481.4	289.0	464.4	292.5
Log of Gains to work	5.8	0.9	5.9	0.9	6.0	0.8	5.9	0.9
Non-labour income	625.5	441.8	657.2	526.1	670.3	473.7	663.3	452.3
Log of Non-labour income	6.2	0.8	6.2	0.9	6.3	0.9	6.3	0.8
Transfers	44.6	73.8	48.2	80.9	48.8	83.4	49.8	81.7
Male	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Female	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Education: Primary	0.2	0.4	0.2	0.4	0.2	0.4	0.1	0.3
Education: Secondary	0.7	0.5	0.7	0.5	0.7	0.5	0.7	0.5
Education: Tertiary	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4
Age 15-24	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4
Age 25-49	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Age 50+	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Age	41.8	16.4	42.3	16.6	42.4	16.5	42.8	16.4
Actual/Potential experience	0.9	1.9	0.9	1.8	0.9	1.7	0.8	1.5
Chronic disease	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
Parent with child under 3y.	0.1	0.2	0.0	0.2	0.0	0.2	0.1	0.3
Parent with child 3-6y.	0.0	0.2	0.0	0.2	0.0	0.2	0.1	0.2
Parent with child over 6y.	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
Pensioner	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4
Student	0.2	0.4	0.2	0.4	0.2	0.4	0.1	0.3
Working Partner	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.5
Family: Single	0.3	0.5	0.4	0.5	0.4	0.5	0.3	0.5
Family: Married	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Family: Separated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Family: Divorced	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.3
Family: Widowed	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2
Density: Dense	0.3	0.4	0.3	0.4	0.2	0.4	0.2	0.4
Density: Average	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.5
Density: Sparse	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5
Mortgages and loans	0.3	0.5	0.2	0.4	0.2	0.4	0.3	0.4
Car ownership	0.7	0.5	0.7	0.5	0.7	0.5	0.7	0.4
Sample size	13064		12547		12682		12350	

Table A3: Estimates of Heckman selection model for gains – to – work (W)

Regression Equation	Females			Males		
Region: Trnava	-0.10	***	(0.02)	-0.14	***	(0.02)
Region: Trencin	-0.16	***	(0.02)	-0.20	***	(0.02)
Region: Nitra	-0.08	***	(0.02)	-0.18	***	(0.02)
Region: Zilina	-0.15	***	(0.02)	-0.16	***	(0.02)
Region: Banska Bystrica	-0.14	***	(0.02)	-0.18	***	(0.02)
Region: Presov	-0.14	***	(0.02)	-0.17	***	(0.02)
Region: Kosice	-0.17	***	(0.02)	-0.20	***	(0.02)
Density: average	0.00		(0.01)	0.01		(0.01)
Density: sparse	-0.02		(0.01)	-0.02		(0.01)
Age	0.10	***	(0.00)	0.12	***	(0.00)
Age^2	-0.12	***	(0.00)	-0.14	***	(0.00)
(EDU : Secondary)*Age	0.00	***	(0.00)	0.00	***	(0.00)
(EDU : Tertiary)*Age	0.01	***	(0.00)	0.01	***	(0.00)
Year 2010	0.03	*	(0.02)	0.04	***	(0.01)
Year 2011	0.10	***	(0.02)	0.10	***	(0.01)
Year 2012	0.07	***	(0.02)	0.09	***	(0.01)
Constant	6.49	***	(0.07)	6.32	***	(0.07)

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: Region (ref. Bratislava), Density of settlement (ref. Dense), AGE (ref. Prime age 25-49), Education (ref. Elementary), Year (ref. 2009)*

Source: authors'calculations

Table A3 (continued): Estimates of Heckman selection model for gains – to – work (W)

Selection Equation	Females			Males		
logNY	-0.13	***	(0.01)	-0.10	***	(0.02)
EDU: Secondary	1.31	***	(0.10)	1.34	***	(0.10)
EDU: Tertiary	1.49	***	(0.11)	1.55	***	(0.12)
AGE: up to 25	-0.61	***	(0.06)	-0.80	***	(0.06)
AGE: 50+	-0.03		(0.05)	0.08		(0.05)
Experience	0.09	***	(0.01)	0.09	***	(0.01)
Experience^2	0.00	**	(0.00)	0.00		(0.00)
Actual/Potential experience	0.02	**	(0.01)	0.09	***	(0.02)
Parent with child under 3y.	-1.44	***	(0.04)	0.55	***	(0.06)
Parent with child 3-6y.	-0.27	***	(0.04)	0.18	***	(0.06)
Parent with child over 6y.	0.10	***	(0.03)	0.30	***	(0.03)
Chronic disease	-0.46	***	(0.03)	-0.63	***	(0.03)
Student	-1.31	***	(0.05)	-1.31	***	(0.06)
Pensioner	-2.14	***	(0.05)	-2.40	***	(0.06)
Region: Trnava	-0.06		(0.05)	0.11	*	(0.06)
Region: Trencin	-0.10	**	(0.05)	0.04		(0.06)
Region: Nitra	-0.20	***	(0.05)	-0.04		(0.06)
Region: Zilina	-0.01		(0.05)	0.05		(0.06)
Region: Banska Bystrica	-0.08		(0.05)	-0.03		(0.06)
Region: Presov	-0.24	***	(0.05)	-0.17	***	(0.05)
Region: Kosice	-0.24	***	(0.05)	-0.18	***	(0.05)
Density: Average	-0.12	***	(0.03)	-0.21	***	(0.03)
Density: Sparse	-0.28	***	(0.03)	-0.27	***	(0.03)
Age	-0.05	***	(0.01)	-0.06	***	(0.01)
Age^2	-0.01		(0.01)	-0.01		(0.01)
(EDU : Secondary)*Age	-0.01	***	(0.00)	-0.02	***	(0.00)
(EDU : Tertiary)*Age	-0.01	**	(0.00)	-0.01	***	(0.00)
Year 2010	-0.03		(0.03)	0.00		(0.03)
Year 2011	0.07	**	(0.03)	0.06	*	(0.03)
Year 2012	0.05		(0.03)	0.04		(0.03)
Constant	2.33	***	(0.24)	2.39	***	(0.26)
N	25 005			21 790		
N censored	12 761			8 596		
LR test of indep. eqns. (rho = 0): chi2(1)	1 121.1	***		1 226.9	***	
inverse Mills ratio (lambda)	-0.41			-0.42		

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: Region (ref. Bratislava), Density of settlement (ref. Dense), AGE (ref. Prime age 25-49), Education (ref. Elementary), Year (ref. 2009)*

Source: authors'calculations

Table A4: Structural probit model (pooled regression 2009-2012)

Dependent variable	ACTIVE						EMPLOYED					
	Females			Males			Females			Males		
$\widehat{\log W}$	0.93	***	(0.12)	0.64	***	(0.10)	1.07	***	(0.11)	0.63	***	(0.09)
logNY	-0.40	***	(0.02)	-0.36	***	(0.03)	-0.34	***	(0.02)	-0.34	***	(0.02)
AGE: Age up to 25	0.20	**	(0.08)	0.33	***	(0.08)	-0.21	***	(0.06)	-0.30	***	(0.07)
AGE: Age 50+	-0.13	***	(0.04)	-0.15	***	(0.05)	0.02		(0.04)	-0.07	*	(0.04)
EDU: Secondary	0.57	***	(0.05)	0.57	***	(0.05)	0.74	***	(0.06)	0.72	***	(0.05)
EDU: Tertiary	0.69	***	(0.07)	0.66	***	(0.08)	0.91	***	(0.07)	0.91	***	(0.06)
Parent with child under 3y.	-2.11	***	(0.05)	0.53	***	(0.10)	-1.67	***	(0.05)	0.53	***	(0.07)
Parent with child 3-6y.	-0.49	***	(0.06)	0.21	**	(0.10)	-0.49	***	(0.05)	0.06		(0.07)
Parent with child over 6y.	0.11	***	(0.04)	0.13	***	(0.05)	0.04		(0.03)	0.04		(0.04)
Pensioner	-2.01	***	(0.06)	-2.43	***	(0.07)	-1.58	***	(0.06)	-2.02	***	(0.06)
Student	-1.43	***	(0.06)	-1.81	***	(0.07)	-0.46	***	(0.05)	-0.45	***	(0.06)
Family: MARRIED	0.20	***	(0.05)	0.33	***	(0.06)	0.08	*	(0.05)	0.47	***	(0.05)
Family: DIVORCED	0.34	***	(0.05)	0.26	***	(0.09)	0.34	***	(0.05)	0.23	***	(0.06)
Family: WIDOWED	0.19	***	(0.06)	-0.01		(0.14)	0.22	***	(0.06)	0.27	**	(0.12)
Chronic disease	-0.71	***	(0.03)	-1.03	***	(0.04)	-0.52	***	(0.03)	-0.74	***	(0.03)
Has Working Partner	0.51	***	(0.04)	0.44	***	(0.04)	0.64	***	(0.04)	0.63	***	(0.04)
Mortgages and loans	0.16	***	(0.03)	0.17	***	(0.03)	0.14	***	(0.02)	0.15	***	(0.03)
Car ownership	0.08	***	(0.03)	0.20	***	(0.03)	0.16	***	(0.03)	0.49	***	(0.03)
Year 2010	-0.09	**	(0.04)	-0.08	*	(0.04)	-0.07	*	(0.04)	-0.08	**	(0.04)
Year 2011	-0.04		(0.04)	-0.07		(0.05)	-0.09	**	(0.04)	-0.09	**	(0.04)
Year 2012	-0.04		(0.04)	-0.17	***	(0.05)	-0.09	**	(0.04)	-0.16	***	(0.04)
Constant	-3.90	***	(0.98)	-1.73	*	(0.92)	-6.39	***	(0.96)	-3.05	***	(0.75)
Observations	25005			21790			25005			21790		
R2 pseudo	0.60			0.65			0.49			0.52		

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: AGE (ref. Prime age 25-49), Education (ref. Elementary), Family status (ref. SINGLE), Year (ref. 2009). Bootstrapped standard errors, 200 replications.*

Source: authors'calculations

CBR
COUNCIL FOR BUDGET
RESPONSIBILITY

Council for Budget Responsibility

Imricha Karvaša 1
Bratislava 1
813 25
Slovakia

www.rozpoctovarada.sk